

Computer and Video Games in Mental Health

Ishita Mehra,¹ Shagufta Nasir,² Anand Prakash^{3,*}

1. Licensed Clinical Psychologist & Private Practitioner, Ludhiana, Punjab, India

2. Assistant Professor in Clinical Psychology, Amity University Rajasthan, Jaipur 303002, India

3. Professor & Dean, School of Medical Sciences, Adamas University, Barrackpore-Barasat Road, Kolkata 700126, India

*: All correspondence should be sent to: Prof. Anand Prakash.

Authors' Contact: Ishita Mehra, E-mail: mehra.ishita1@gmail.com; Shagufta Nasir, E-mail: shaguftanasir1593@gmail.com; Anand Prakash,

E-mail: anandprakash72@gmail.com

DOI: <https://doi.org/10.15354/si.23.re261>

Funding: No funding source declared.

COI: The authors declare no competing interest.

Due to the breakthrough of new technological devices in the last decade, electronic media has now become an integral part of our lives. Among its various forms, playing video games is one screen-based recreational activity enjoyed across various age groups and genders. Although undoubtedly entertaining, there is a considerable debate over the relative impact of video gaming on an individual. Traditionally, the research has focused on the negative effects of playing video games, but recent studies show that they can be an effective tool to reduce stress caused by daily hassles, help connect with likeminded people, and enhance a wide range of cognitive skills. There is also a small pool of research on the use of commercial video games in a therapeutic capacity to help build rapport and provide social skill training. This manuscript is focused on reviewing the pertinent research of the last two decades and from various online sources of scientific information on the abovementioned aspects of electronic and video games, their therapeutic implications in mental health, and suggesting future research directions.

Keywords: Video Games; Computer Games; Mental Health; Psychological Impact; Cognitive Skills

Science Insights, 2023 April 30; Vol. 42, No. 4, pp.877-883.

© 2023 Insights Publisher. All rights reserved.



Creative Commons Non Commercial CC BY-NC: This article is distributed under the terms of the [Creative Commons Attribution-NonCommercial 4.0 License](https://creativecommons.org/licenses/by-nc/4.0/) which permits non-commercial use, reproduction and distribution of the work without further permission provided the original work is attributed by the Insights Publisher.

Introduction

THESE has been an explosion of new technological devices in the last decade, making electronic media an integral part of our lives. Today, exposure to screens starts right from early infancy, and children spend a substantial amount of the day on screen-based activities (1). Video gaming is one such screen-based recreational activity that is popular. "Videogames", within the context of this write-up, refer to electronic games available in different genres (puzzle, action, strat-

egy, action, adventure, arcade, sports, skill- or chance-based) on various devices such as consoles (PlayStation, Nintendo vii), PC/laptop, mobile/tablet, online or offline, in different player formats (single or multiple player), via various channels of access (browser-based, app-based, or preloaded/offline purchase channels).

Contrary to popular belief, only children and adolescents indulge in video games. Statistics show that in 2005, the average age of a gamer was 24, in 2011, it was 30, and in 2015, it rose to

35 years. Surprisingly, 27% of the gaming market consists of players older than 50 years.

Early research suggested that the realm of video games has traditionally been dominated by males; now, the gender gap has started to narrow as more and more females are entering the space. In the US, approx. 40% are female gamers (2). Males and younger gamers tend to prefer action and strategy-focused games, while females and older gamers prefer games of skill (3). Older adults (mean age 71.94) tend to prefer slow-paced casual games such as card or puzzle-based games (Solitaire, Freecell, Scrabble, and Bejeweled) (4). They also argued that since cognitive abilities decline with age, it makes action games less enjoyable for older players, who preferred digital versions of the games closer to their childhoods and preferred using a PC to play games on (4, 5).

While the novel Corona virus brought the whole world to a standstill, the gaming industry remained unaffected and saw a substantial increase in the number of users' engagements, especially those aged between 25 and 35 years of age. Presently, the video gaming industry has a turnover of nearly \$100 billion worldwide (6). The statistics of the gaming market in Asia Pacific are 1.5 billion out of 4 billion online players in 2016. India alone had 120 million players online on various devices. In 2019, the number more than doubled to approx. 300 million users, and it's expected to reach around 500 million users by the end of the fiscal year 2022.

The research on video gaming and its effects on mental health has seen many transitions in the scientific literature. In the 1980s, research was mainly centered on 'pay-to-play' arcade video games. In the 1990s, research was focused on offline video games played at home on consoles, PCs, or handhelds. Today in the 2000s, research is focused on massively multiplayer online role-playing games (MMORPGs) such as World of Warcraft, Final Fantasy XIV, and GuildWars 2 (7).

The current paper is a review of the various empirical and review research articles written about the impact of computers and video games on mental health to expand knowledge and understand the scope for future research. An extensive review of the literature of the last twenty years was conducted on the impact of video and computer games on psychological health using various search engines like Google Scholar, PubMed, Psycinfo, Researchgate, APA Psycnet, Mendley, etc. The keywords used in the literature search were video games and well-being, computer games and health, cyberplays and mental health, and electronic entertainment on mental health, psychological issues, and emotional well-being, etc. The authors have highlighted positive and negative effects of video and computer games on mental well-being, pertinent causes, the role of such games in psychological intervention, and insights on further plausible research for robust findings and conclusions.

Benefits of Playing Video Games

Traditionally, research focused on the negative effects of playing video games, especially violent video games. Now, there has also been a growing body of research on the positive effects and impacts of video games. Despite contrary evidence that video games can make one lazy, it turns out that video games can enhance a wide range of cognitive skills.

Spatial Skills and Awareness

A meta-analysis published by Uttal and coworkers showed that playing commercial shooter games enhanced spatial skills and was comparable to university-level courses focused on the same (8). This review also concluded that such games can be used as training tools to hone spatial skills, and the benefits of these trainings last for a period of time as they manifest changes in neural processing and efficiency. A 25-year longitudinal study with a U.S. representative sample concluded that spatial skills can be a predictor for achievement in science, technology, engineering, and mathematics (STEM) (9).

It has been observed that playing commercial computer games enhances cognitive flexibility and results in improved visuospatial working memory, visuospatial learning, and focused attention (10).

Problem-Solving

Because children and adolescents are exposed to a multitude of open-ended problems and games, they are more likely to problem-solve through trial and error. A longitudinal study conducted by Adachi and Willoughby showed that the adolescents who reported playing strategic video games displayed higher problem-solving skills when followed up the following year (11). The same positive predictive association was not found for fast-paced games such as racing and fighting games.

Pro-Social Behavior

Video games that involve a social component, such as playing together as a team, have shown to have positive benefits on psychological well-being as it leads to more interaction, enjoyment, and lower levels of aggression if played in moderation (12, 13).

Negative Effects of Video Games

The negative consequences of problematic use of video games aren't just long, extended hours of play but also include additional issues such as craving, loss of control, maladaptive coping styles (14), a lack of real-life friends (15), and decreased academic achievement (16).

Health Issues

As gaming involves long sitting hours and inactivity, playing games online has been associated with musculoskeletal problems like pain in various body parts and the development of obesity (17). It's noted that extensive staring at a game screen can cause strain on the eyes as various parts of the eye are not biologically made for heavy viewing on digital screens (18). It's also been seen that gaming can decrease plasma catecholamine norepinephrine (NE) and epinephrine (Epi) levels over time, inducing a cardiovascular stress reaction (19).

Psychological Issues

Excessive gaming is related to psychological issues such as diminished sleep, low concentration, and poor self-control (20). A study found that playing video games over computers or consoles was associated with insufficient rest and shorter sleep duration (21). Von Der Heiden et al. found a medium-sized positive relation between problematic use of video games and the

emergence of psychological symptoms including depression, anxiety, and hostility (3). The study also noted a correlation between self-blame, behavioral disengagement, denial, substance use, and problematic video gaming. Another potential issue with problematic video game use is that it may lead to other psychological issues as it decreases the amount of time available to pursue and practice other opportunities available in real life (16).

Academic Achievement

Extreme engagement in gaming is also strongly related to concentration issues and lower academic grades among school-going children and adolescents (3, 22).

Personality Traits

The degree to which video gaming can be addictive has been linked to certain personality traits such as shyness, lower self-esteem (23), low self-efficacy (24), a preference for personal solitude, aggression, and even clinical symptoms of anxiety and depression.

Aggression

One genre of video games that is famous and well-studied by researchers is violent video games. Most of the research in this domain has examined the effects of violent video games on aggressive behavior.

A meta-analysis involving 4,626 participants found violent video games increase aggressive behavior, aggressive cognitions, aggressive emotions, increase physiological arousal, and decrease prosocial behavior (25, 26). A correlational study found adolescents who were more characteristically aggressive were more likely to engage in aggressive behaviors due to violent video games (27). A study conducted by Gentile et al. confirmed similar results: exposure to video game violence is positively correlated with the trait of hostility, and individuals high on this trait are also more likely to get into arguments and physical fights (28). A meta-analysis conducted by Anderson et al. showed that exposure to violent video games was associated with desensitization to aggression, a lack of empathy, and prosocial behavior (25). They also found that the effects of video game violence were similar for both western and eastern countries, although slightly more for western countries, but these results were seen only in non-experimental studies.

Reasons for Playing Video Games

As videogames have evolved over time, the attention, time, and commitment required to play these games have also evolved and moved far beyond leisure. While female players are more likely to engage in multiplayer platforms to build supportive relationships (29, 30), male players are driven more by a sense of accomplishment and power. Other reasons why individuals indulge in playing video games are as follows:

Source of Elevated Mood

Gaming is an effective way used by youth to generate positive feelings, and several studies have shown a causal relationship between playing video games and overall improved mood. A study by von der Heiden et al. reported that gamers who played

video games as a tool for distraction, to relax from day-to-day hassles, to form social relations, and to stimulate imagination showed more positive affect than negative affect (3). Highly accessible puzzle-solving games like Angry Birds and Bejeweled II, which have a minimal interface and short-term tasks, can decrease anxiety, and promote relaxation (31). It's also been shown that video games help regulate emotion, release stress, and relax (32).

Feedback and Reinforcement

Most games today are based on reward features, meaning that players gain awards for completing certain game milestones (names on the hall of fame) in return for reinforcing their skillful play (33). For example, games such as Call of Duty (COD Elite) and Battlefield 3 now have their own social networking sites that track player performance and provide feedback to players as to how to improve their game (beat their own or best friend's score), reinforcing video game play (34).

Meaning

Another reason for playing is attaching meaning to playing. Connecting with millions of players across the globe gives gamers a sense of involvement and purpose; players feel that they are a part of something bigger than themselves and want to contribute to drive that sense of fulfillment into their daily lives.

Social Interaction

Video games today are social in nature as compared to their predecessors of 10-20 years ago, meaning that now games can be played competitively or cooperatively with friends or with any individual throughout the globe. Cole & Griffiths concluded that the social interactions that occur within and outside the game give players an opportunity to form friendships with players all around the world (29). Their study participants also reported that video gaming platforms gave them a safe space, allowing them to freely express themselves, something they are uncomfortable doing in real life.

Internet Gaming Disorder/Gaming Disorder

Excessive gaming can lead to clinical presentations of behavior and multiple domains of functioning in a small subset of players. It causes symptoms of withdrawal, loss of control, and interpersonal or intrapersonal conflicts (16) and can put a few players at risk of developing Internet gaming disorder or gaming disorder.

In 2013, DSM-5 recognized Internet gaming disorder and gave nine criteria to diagnose it. The World Health Organization (WHO), in the 11th revision of its International Classification of Diseases (ICD-11) on June 18, 2018, also classified gaming disorder as a mental health disorder. The ICD-11 defines it as severe gaming behavior that results in significant impairment in areas of day-to-day functioning. With the inclusion of IGD as diagnostic criteria in both DSM 5 and ICD 11, it is also vital to evaluate its varied worldwide prevalence. This is majorly due to two reasons: first, the debate around the conceptualization of the disorder has resulted in a lack of agreed-upon criteria to define it, and second, there is a lack of empirically validated assessment tools.

To date, the data available is heterogeneous in nature, and

many research teams, especially in Europe and Asia, have been working towards getting an estimate. For example, a systematic review of 27 studies by Feng et al. reported a prevalence ranging from 0.7% to 15.6% among schoolchildren (35), whereas one of the largest studies conducted till date by Mihara & Higuchi, which examined 50 studies, found the prevalence estimates ranging from 0.7% to as high as 27.5% (36). Most authors have noted that such diversification is mostly due to the different methodologies adopted in the studies, making it difficult to compare the prevalence estimates across studies. A few have also pointed out that cultural and demographic factors also play an important role in addressing the variation.

It is seen that GD prevalence was 2.5 times higher in males as compared to females (37). Despite lower rates, it was seen that female rates have increased over the last decade. In 2017, the rate was 4.47% as compared to 1.75% in 2009 (38). It was also seen to be more prevalent in adolescents than adults.

Assessment, Treatment, and Management of IGD and GD

Many measures with varying degrees of psychometric properties have been used to research gaming, but empirically validated assessment tools that are specific to gaming disorders are sparse (39). Still, two self-reported questionnaires are now getting recognition. The first is the Internet Gaming Disorder Scale-Short Form (IGDS9-SF). It is a nine-item measure based on a 5-point Likert scale modeled after the diagnostic criteria of DSM 5. However, there is an empirically validated specific cut-off score to detect IGD (40). The second self-report questionnaire is based on the diagnostic framework of ICD 11 and is called the Gaming Disorder Test (GDT), which is a four-item measure based on a 5-point Likert scale, with total scores ranging from 4 to 20. However, similar to IGDS9-SF, it also does not have an empirically validated specific cutoff score to detect IGD (41).

Till date, there have been very few controlled studies to understand the best treatment for IGD, and there is weak research support for any one treatment approach (42). This is mostly due to small sample sizes, a lack of randomization, and the lack of control groups (37). Even though the research on treatments for IGD is still in its infancy stage, a few studies have explored the use of psychological treatments and pharmacological interventions as treatment options for IGD/GD (43). Two randomized control studies conducted by Bae et al. (44) and Song et al. (45) showed efficacy for bupropion over escitalopram, but both studies had small sample sizes and the duration of treatment was only 8 weeks, not enough to establish treatment efficacy. Although bupropion shows a little evidence of efficacy, more well-designed RCTs are needed not only to understand the effect of medication on IGD/GD but also to shed light on comorbid conditions like inattention, depression, and anxiety.

A study conducted by Torres-Rodriguez et al. on adolescents compared a specialized program of CBT (Programa Individualizado Psicoterapéutico para la Adicción a las Tecnologías de la Información y la Comunicación - PIPATIC) to standard CBT for IGD/GD and found that both groups showed major reductions in the amount of time spent on game play time

post-treatment, and the specialized CBT proved to be superior to standard CBT (43). Further, both groups maintained their improvements at a 3-month follow-up. A recent meta-analysis found that CBT not only reduced IGD symptoms but also decreased comorbid symptoms of anxiety and depression after treatment (37).

Other interventions identified are eclectic approaches to treatment, such as family therapy, mindfulness-centered approaches, motivational interviewing, and supportive therapy. Pilot studies conducted on these suggest the need for additional evaluation (42).

Recommendations for Clinicians

Monitoring Game Time

An effective way of tracking daily gaming behavior is to keep tabs on it. This helps provide the individual with insight into their level of engagement and their patterns of play. This is helpful to understand the antecedents and consequences of one's play (46).

Setting Time Limits

This can help to understand and adjust the desired level of play. This can be done by limiting the total number of hours spent playing and also by limiting the number of games played in a day. It's better to set a moderate rather than an abstinence goal (39).

Understanding Patterns of Play

It is beneficial to understand what patterns of play an individual displays, e.g., whether the person plays it daily, on weekends, or when a new game is released. The game pattern helps understand behavioral patterns and common triggers leading to short- and long-term consequences of such engagement (39).

Establishing Activities as a Substitute for Gaming

Clients should be encouraged to identify pleasure activities to engage in before they start gaming excessively. These activities should be readily available and in line with the values of the client.

Integrating Parental Support

Correcting maladaptive patterns of communication through psychoeducation around supportive communication styles may be a helpful start.

Recommendations for Parents

Mark D. Griffiths, a pioneer who has published several pertinent studies since the 1990s, has a few recommendations for parents. He advises parents to monitor TV viewing in children; keeping a check on the content of the video games played can be beneficial (7). He points out that the social component—encouraging video gaming as a social rather than solitary activity—can help keep feelings of loneliness in check. He also recommends using strategies like setting time limits on games and following the instructions and recommendations given by the game manufacturer at the back of the game for adequate play.

Unfortunately, despite rapid development in research for treatments for IGD, none of the treatment approaches mentioned above have been studied enough to establish their efficacy. Existing literature suggests an integrative approach to treatment known as IGD/GD that focuses on comorbid disorders such as anxiety and depression and also associated psychological problems such as low self-esteem, poor social skills, low academic performance, and family deficits (43).

Use of Video Games in Therapy

There is a small pool of research on the use of commercial video games in a therapeutic capacity. Games are shown to be useful to help build rapport and provide social skill training (47).

A randomized controlled study conducted by Fish and colleagues showed that playing puzzle games such as Tetris and Bejeweled provides unique qualities that traditional therapies may not provide (48). These games have been shown to reduce depression and stress. Computer games like FreeCell and Klondike have shown helpful to monitor adults with mild cognitive impairment (49), while reality games like Pokémon GO and Zombie Run could prove useful to promote physical activity (50). Since playing video games can be engaging and stimulating, they are shown to assist patients in setting goals, ensuring goal rehearsal, providing feedback and reinforcement, and maintaining records of behavioral change (7).

Conclusion

Overcoming the dichotomy of whether video games are “good” or “bad,” “violent” or “non-violent,” is essential to understanding the complexity of how video games interact with one’s cognition.

In the short run, a shorter duration of game play may have a positive effect by reducing stress caused by daily hassles, helping connect with likeminded people, and combating feelings of loneliness, all of which act as reinforcers. It’s also shown to improve cognitive processes such as spatial awareness, attention, and decision-making skills. However, in the longer run, exces-

sive screen time may prevent a person from developing psychologically healthy coping mechanisms, low academic achievement, the development of physical ailments, and even IGD or GD. Excessive video gaming can be better understood through the lens of factors such as rejection by peers, personality traits such as low confidence, and feeling emotions such as sadness, anger, and aggression.

It’s also essential to take the reasons for play into account to fully understand the relationship between computers and video games and mental health. Other than playing to distract oneself or regulate poor psychological functioning, playing video games to experience positive emotions and connecting online with friends can also be a predictor for potential problematic video games as these factors have a reinforcement value. Typically, research on the negative effects of video gaming has been focused more on the genre of violent or action video games, thereby neglecting the possibility of effects on other genres mental health. There is still a gap in the literature that sheds light on the outcomes of moderate video gaming, be they social or emotional benefits, and this gap needs to be explored more to understand the different correlates of video gaming. It’s still largely an unexplored area in the field of mental health and holds immense potential to develop interventions. It could be interesting to investigate the impacts of video and computer games, etc. in terms of socio-demographic variables such as gender, age groups, religion, culture, race, socio-economic status, geographical locations, and alike. Besides, some psychological factors can also be explored, like the impact of parenting and cognitive style on the selection and influence of such electronic entertainment. Further, if there is an impact of season on selecting electronic games and its influence on psychological well-being. Last but not least, it could also be inquisitive to investigate the role of locus of control in preventing the harmful impact of such games as well as enhancing their desirable impact on the skill development of people in general and children and adolescents in particular. ■

References

1. Domingues-Montanari S. Clinical and psychological effects of excessive screen time on children. *J Paediatr Child Health* 2017; 53(4):333-338. DOI: <https://doi.org/10.1111/jpc.13462>
2. Primack BA, Carroll MV, McNamara M, Klem ML, King B, Rich M, Chan CW, Nayak S. Role of video games in improving health-related outcomes: A systematic review. *Am J Prev Med* 2012; 42(6):630-638. DOI: <https://doi.org/10.1016/j.amepre.2012.02.023>
3. von der Heiden JM, Braun B, Müller KW, Egloff B. The association between video gaming and psychological functioning. *Front Psychol* 2019; 10:1731. DOI: <https://doi.org/10.3389/fpsyg.2019.01731>
4. Chesham A, Wyss P, Muri RM, Mosimann UP, Nef T. What older people like to play: Genre preferences and acceptance of casual games. *JMIR Serious Games* 2017; 5(2):e8. DOI: <https://doi.org/10.2196/games.7025>
5. Brown JA. Exploring the Next Generation of Older Gamers: Middle-Aged Gamers. In: Zhou, J., Salvendy, G. (eds) *Human aspects of IT for the aged population. healthy and active aging*. ITAP 2016. *Lect Notes Comput Sci* 2016; 9755. Springer, Cham. DOI: https://doi.org/10.1007/978-3-319-39949-2_30
6. King DL; Gaming Industry Response Consortium. Comment on the global gaming industry's statement on ICD-11 gaming disorder: A corporate strategy to

- disregard harm and deflect social responsibility? *Addiction* 2018; 113(11):2145-2146. DOI: <https://doi.org/10.1111/add.14388>
7. Griffiths MD. Online Games, Addiction and Overuse of. In *The International Encyclopedia of Digital Communication and Society* 2014; pp.1-6. Wiley. DOI: <https://doi.org/10.1002/9781118767771.wbiedcs044>
 8. Uttal DH, Meadow NG, Tipton E, Hand LL, Alden AR, Warren C, Newcombe NS. The malleability of spatial skills: A meta-analysis of training studies. *Psychol Bull* 2013; 139(2):352-402. DOI: <https://doi.org/10.1037/a0028446>
 9. Wai J, Lubinski D, Benbow CP, Steiger JH. Accomplishment in science, technology, engineering, and mathematics (STEM) and its relation to STEM educational dose: A 25-year longitudinal study. *J Educ Psychol* 2010; 102(4):860-871. DOI: <https://doi.org/10.1037/a0019454>
 10. Peretz C, Korczyn AD, Shatil E, Aharonson V, Birnboim S, Giladi N. Computer-based, personalized cognitive training versus classical computer games: A randomized double-blind prospective trial of cognitive stimulation. *Neuroepidemiology* 2011; 36(2):91-99. DOI: <https://doi.org/10.1159/000323950>
 11. Adachi PJ, Willoughby T. More than just fun and games: The longitudinal relationships between strategic video games, self-reported problem solving skills, and academic grades. *J Youth Adolesc* 2013; 42(7):1041-1052. DOI: <https://doi.org/10.1007/s10964-013-9913-9>
 12. Ewoldsen DR, Eno CA, Okdie BM, Velez JA, Guadagno RE, DeCoster J. Effect of playing violent video games cooperatively or competitively on subsequent cooperative behavior. *Cyberpsychol Behav Soc Netw* 2012; 15(5):277-280. DOI: <https://doi.org/10.1089/cyber.2011.0308>
 13. Schmierbach M, Xu Q, Oeldorf-Hirsch A, Dardis FE. Electronic friend or virtual foe: Exploring the role of competitive and cooperative multiplayer video game modes in fostering enjoyment. *Media Psychol* 2012; 15(3):356-371. DOI: <https://doi.org/10.1080/15213269.2012.702603>
 14. Milani L, La Torre G, Fiore M, Grumi S, Gentile DA, Ferrante M, Miccoli S, Di Blasio P. Internet gaming addiction in adolescence: Risk factors and maladjustment correlates. *Int J Ment Health Addict* 2018; 16(4):888-904. DOI: <https://doi.org/10.1007/s11469-017-9750-2>
 15. Kowert R, Domahidi E, Quandt T. The relationship between online video game involvement and gaming-related friendships among emotionally sensitive individuals. *Cyberpsychol Behav Soc Netw* 2014; 17(7):447-453. DOI: <https://doi.org/10.1089/cyber.2013.0656>
 16. Gentile D. Pathological video-game use among youth ages 8 to 18: A national study. *Psychol Sci* 2009; 20(5):594-602. DOI: <https://doi.org/10.1111/j.1467-9280.2009.02340.x>. Erratum in: *Psychol Sci* 2009; 20(6):785.
 17. Zirek E, Mustafaoglu R, Yasaci Z, Griffiths MD. A systematic review of musculoskeletal complaints, symptoms, and pathologies related to mobile phone usage. *Musculoskelet Sci Pract* 2020; 49:102196. DOI: <https://doi.org/10.1016/j.msksp.2020.102196>
 18. Ayenigbara I. Gaming disorder and effects of gaming on health: An overview. *J Addict Med Therap Sci* 2018; 2018:1-3. DOI: <https://doi.org/10.17352/2455-3484.000025>
 19. Kim N, Hughes TL, Park CG, Quinn L, Kong ID. Resting-state peripheral catecholamine and anxiety levels in Korean male adolescents with internet game addiction. *Cyberpsychol Behav Soc Netw* 2016; 19(3):202-208. DOI: <https://doi.org/10.1089/cyber.2015.0411>
 20. Männikkö N, Ruotsalainen H, Miettunen J, Pontes HM, Kääriäinen M. Problematic gaming behaviour and health-related outcomes: A systematic review and meta-analysis. *J Health Psychol* 2020; 25(1):67-81. DOI: <https://doi.org/10.1177/1359105317740414>
 21. Peracchia S, Curcio G. Exposure to video games: Effects on sleep and on post-sleep cognitive abilities. A systematic review of experimental evidences. *Sleep Sci* 2018; 11(4):302-314. DOI: <https://doi.org/10.5935/1984-0063.20180046>
 22. Amin KP, Griffiths MD, Dsouza DD. Online gaming during the COVID-19 pandemic in India: strategies for work-life balance. *Int J Ment Health Addict* 2022; 20(1):296-302. DOI: <https://doi.org/10.1007/s11469-020-00358-1>
 23. Jeong EJ, Kim DJ, Lee DM. Game addiction from psychosocial health perspective. *ACM International Conference Proceeding Series* 2015; 1-9. DOI: <https://doi.org/10.1145/2781562.2781587>
 24. Jeong EJ, Kim DH. Social activities, self-efficacy, game attitudes, and game addiction. *Cyberpsychol Behav Soc Netw* 2011; 14(4):213-221. DOI: <https://doi.org/10.1089/cyber.2009.0289>
 25. Anderson CA, Shibuya A, Ihori N, Swing EL, Bushman BJ, Sakamoto A, Rothstein HR, Saleem M. Violent video game effects on aggression, empathy, and prosocial behavior in eastern and western countries: A meta-analytic review. *Psychol Bull* 2010; 136(2):151-173. DOI: <https://doi.org/10.1037/a0018251>
 26. Shao R, Wang Y. The relation of violent video games to adolescent aggression: An examination of moderated mediation effect. *Front Psychol* 2019; 10:384. DOI: <https://doi.org/10.3389/fpsyg.2019.00384>
 27. Anderson CA, Dill KE. Video games and aggressive thoughts, feelings, and behavior in the laboratory and in life. *J Pers Soc Psychol* 2000; 78(4):772-790. DOI: <https://doi.org/10.1037//0022-3514.78.4.772>
 28. Gentile DA, Lynch PJ, Linder JR, Walsh DA. The effects of violent video game habits on adolescent hostility, aggressive behaviors, and school performance. *J Adolesc* 2004; 27(1):5-22. DOI: <https://doi.org/10.1016/j.adolescence.2003.10.002>
 29. Cole H, Griffiths MD. Social interactions in massively multiplayer online role-playing gamers. *Cyberpsychol Behav* 2007; 10(4):575-583. DOI: <https://doi.org/10.1089/cpb.2007.9988>

30. Snodgrass JG, Dengah HJF 2nd, Polzer E, Else R. Intensive online videogame involvement: A new global idiom of wellness and distress. *Transcult Psychiatry* 2019; 56(4):748-774. DOI: <https://doi.org/10.1177/1363461519844356>
31. Granic I, Lobel A, Engels RC. The benefits of playing video games. *Am Psychol* 2014; 69(1):66-78. DOI: <https://doi.org/10.1037/a0034857>
32. Olson CK, Kutner LA, Warner DE. The role of violent video game content in adolescent development: Boys' perspectives. *J Adolesc Res* 2008; 23(1):55-75. DOI: <https://doi.org/10.1177/0743558407310713>
33. Pallavicini F, Ferrari A, Mantovani F. Video games for well-being: A systematic review on the application of computer games for cognitive and emotional training in the adult population. *Front Psychol* 2018; 9:2127. DOI: <https://doi.org/10.3389/fpsyg.2018.02127>
34. Gentile DA, Bailey K, Bavelier D, Brockmyer JF, Cash H, Coyne SM, Doan A, Grant DS, Green CS, Griffiths M, Markle T, Petry NM, Prot S, Rae CD, Rehbein F, Rich M, Sullivan D, Woolley E, Young K. Internet gaming disorder in children and adolescents. *Pediatrics* 2017; 140(Suppl 2):S81-S85. DOI: <https://doi.org/10.1542/peds.2016-1758H>
35. Feng W, Ramo DE, Chan SR, Bourgeois JA. Internet gaming disorder: Trends in prevalence 1998-2016. *Addict Behav* 2017; 75:17-24. DOI: <https://doi.org/10.1016/j.addbeh.2017.06.010>
36. Mihara S, Higuchi S. Cross-sectional and longitudinal epidemiological studies of Internet gaming disorder: A systematic review of the literature. *Psychiatry Clin Neurosci* 2017; 71(7):425-444. DOI: <https://doi.org/10.1111/pcn.12532>
37. Stevens MW, Dorstyn D, Delfabbro PH, King DL. Global prevalence of gaming disorder: A systematic review and meta-analysis. *Aust N Z J Psychiatry* 2021; 55(6):553-568. DOI: <https://doi.org/10.1177/0004867420962851>
38. King DL, Potenza MN. Gaming disorder among female adolescents: A hidden problem? *J Adolesc Health* 2020; 66(6):650-652. DOI: <https://doi.org/10.1016/j.jadohealth.2020.03.011>
39. Peter SC, Ginley MK, Pfund RA. Assessment and treatment of internet gaming disorder. *J Health Serv Psychol* 2020; 46(1):29-36. DOI: <https://doi.org/10.1007/s42843-020-00005-2>
40. Pontes HM, Griffiths MD. New concepts, old known issues: The DSM-5 and internet gaming disorder and its assessment. In *Psychological and Social Implications Surrounding Internet and Gaming Addiction*, 2015; pp.16-30. IGI Global. ISBN13: 978146668595. DOI: <https://doi.org/10.4018/978-1-4666-8595-6.ch002>
41. Pontes HM, Schivinski B, Sindermann C, Li M, Becker B, Zhou M, Montag C. Measurement and conceptualization of gaming disorder according to the world health organization framework: The development of the gaming disorder test. *Int J Ment Health Addict* 2019; 2019:1-21. DOI: <https://doi.org/10.1007/s11469-019-00088-z>
42. Zajac K, Ginley MK, Chang R. Treatments of internet gaming disorder: A systematic review of the evidence. *Expert Rev Neurother* 2020; 20(1):85-93. DOI: <https://doi.org/10.1080/14737175.2020.1671824>
43. Torres-Rodríguez A, Griffiths MD, Carbonell X, Oberst U. Treatment efficacy of a specialized psychotherapy program for Internet Gaming Disorder. *J Behav Addict* 2018; 7(4):939-952. DOI: <https://doi.org/10.1556/2006.7.2018.111>
44. Bae S, Hong JS, Kim SM, Han DH. Bupropion shows different effects on brain functional connectivity in patients with internet-based gambling disorder and internet gaming disorder. *Front Psychiatry* 2018; 9:130. DOI: <https://doi.org/10.3389/fpsyg.2018.00130>
45. Song J, Park JH, Han DH, Roh S, Son JH, Choi TY, Lee H, Kim TH, Lee YS. Comparative study of the effects of bupropion and escitalopram on Internet gaming disorder. *Psychiatry Clin Neurosci* 2016; 70(11):527-535. DOI: <https://doi.org/10.1111/pcn.12429>
46. Petry NM. *Pause and Reset: A Parent's Guide to Preventing and Overcoming Problems with Gaming*. Oxford University Press, 2019; ISBN: 9780190279509. Available at: https://www.google.com/books/edition/_/8hGCswEACAAJ?hl=en&sa=X&ved=2ahUKEwjkq5W5gar-AhWDF1kFHSa7D-QQ7_IDegQIChAD
47. Colder Carras M, Van Rooij AJ, Spruijt-Metz D, Kvedar J, Griffiths MD, Carabas Y, Labrique A. Commercial video games as therapy: A new research agenda to unlock the potential of a global pastime. *Front Psychiatry* 2018; 8:300. DOI: <https://doi.org/10.3389/fpsyg.2017.00300>
48. Fish MT, Saul AD. The gamification of meditation: A randomized-controlled study of a prescribed mobile mindfulness meditation application in reducing college students' depression. *Simul Gaming* 2019; 50(4):419-435. DOI: <https://doi.org/10.1177/1046878119851821>
49. Gielis K, Brito F, Tournoy J, Vanden Abeele V. Can card games be used to assess mild cognitive impairment? A study of Klondike Solitaire and cognitive functions. *CHI PLAY 2017 Extended Abstracts - Extended Abstracts Publication of the Annual Symposium on Computer-Human Interaction in Play*, 2017; 269-276. DOI: <https://doi.org/10.1145/3130859.3131328>
50. Althoff T, White RW, Horvitz E. Influence of pokémon go on physical activity: Study and implications. *J Med Internet Res* 2016; 18(12):e315. DOI: <https://doi.org/10.2196/jmir.6759>

Received: April 08, 2023 | Revised: April 16, 2023 | Accepted: April 20, 2023
